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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/039,438

Filing Date: March 16, 1998

Appellant(s): SHIN ET AL.

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GROUP 1700

Eric J. Nuss
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed July 25, 2007 appealing from the Office action mailed December 12, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,560,838	Allies; Victoria R. et al.	10-1996
5,000,795	Chung; Bryan C. et al.	03-1991
4,886,590	Tittle; Douglas L.	12-1989

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4,338,157	Kanda; Kunihiko	06-1982
3,869,313	Jones; Harold F. et al.	03-1995
3,532,568	Schutt John B et al.	11-1967

Physics for Scientists & Engineers, 2nd Ed. R.A. Serway, Saunders College Publishing, 1986. pp. 428 (see top-most equation).

(9) Grounds of Rejection

The following grounds of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schutt (US 3,532,568 A) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and Allies, Victoria R. et al (U.S.Pat. 5,560,838). Schutt discloses an etching process and apparatus for chemically etching ("etching zone 1"; Sole figure) material from a substrate (copper, abstract). An etched product (iron; column 2, lines 1-10) is etched in unit 1 (Applicant's "etch bath") thereby at least contacting the solid with the aqueous liquid (sulfuric acid, HCl; column 1, lines 65-68) and the resulting liquid (3) is passed through an ion exchanger (8) to remove the ions from the rinse liquid which is reused or discharged. The solids are removed from an etcher ("etch bath") via a stream (3) which passes into a rinse chamber (5) including outlet pipe (7). The rinse liquid stream (7) then goes through an ion exchanger means (8, second tank). A replenishing solution (9) from the ion exchange means is combined with the bulk storage tank (11, first tank) going to the etcher (1). The bulk storage tank (11, first tank) has a stream flowing to the etcher (1) for etching the product.

Schutt does not disclose an immersion of a substrate in an etched bath or a bubble plate used therein.

Chung et al disclose a bubble plate (17) located on the floor of a tank (10; Fig. 1). The bubble plate (17) transmits inert gas to create a bubbling condition within the tank (10) for sufficient agitation (col. 1, lines 60-68). Silicon substrates (14; column 3, lines 44-48) are immersed in an etch bath ("hot sulfuric acid"; 13; Fig. 2; col. 2, lines 25-38; column 3, lines 44-48).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to replace the spray etcher of Schutt with the etch bath and bubble plate of Chung et al.

The motivation for doing so would be to replace the etchant delivery means (ie, sparger etcher) with an alternate and equivalent etching means (ie a bath etcher).

Schutt and Chung et al do not teach a temperature sensor and control unit.

Kanda et al disclose a process control system (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) having a thermocouple for measuring the temperature of the etching solution (8, Figure 2; column 9, lines 22-23) used to etch a submerged substrate (2, Figure 3). Kanda specifically teaches a control unit (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) for receiving a signal indicating the temperature (T) of the etchant from a temperature sensor ("thermocouple") and transmitting an etching termination signal (P_0) to the etch bath when the temperature reaches a target temperature. Further, Kanda teaches the etched thickness (Q; column 10, lines 10-15) of the substrate is derived from the temperature (T) of the first etchant.

Schutt, Chung, and Kanda do not teach using the total reaction energy as a reference. Schutt, Chung, and Kanda do not teach a controller that controls the first tank, the etch bath and the

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second tank. Schutt, Chung, and Kanda do not teach using gravity (i.e. weight) for separating the diluted etchant from the residual material.

Allies teaches a controller (340; Figure 3; column 3, lines 55-60) that controls the volume of fluid within numerous process tanks (column 3, lines 58-67), including controlling the temperature of said tank(s) (column 3, lines 58-67) resulting from numerous input signals (column 4, lines 1-10). Allies further teaches teach using gravity (i.e. weight) for separating the etchant (CuCl₂ etchant – column 3, lines 37-40) from residual material by mass/material filtration in filtration tank 338, Figure 3 – column 5, line 64 - column 6, line 5

At the time of the invention it would have been obvious to a person of ordinary skill in the art to control the etching operation for the etching apparatus of Schutt with the chemical processing control system of Kanda and Allies including using the total reaction energy as a reference by replacing Kanda's temperature in any of Kanda's "Q" equations (column 10) with "reaction energy" as derived from the well know thermodynamic relationship between molar enthalpy (per unit mass), heat capacity, and temperature¹:

$$\frac{\partial H}{\partial T} \equiv c_p$$

The motivation for controlling the etching operation for the etching apparatus of Schutt and Chung et al with the chemical processing control system of Kanda and Allies, using "reaction energy", would have been to detect the termination of etching appropriately and precisely as taught by Kanda (column 10, lines 44-47) by an alternate a equivalent means of detecting said termination in using "reaction energy".

¹ As demonstrated (MPEP 2116.01) in Physics for Scientists & Engineers, 2nd Ed. R.A. Serway, Saunders College Publishing, 1986. pp. 428 (see top-most equation).

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At the time of the invention it would have been obvious to a person of ordinary skill in the art to add Allies's mass/material separation filtration tank to Schutt's processing system.

The motivation to add Allies's mass/material separation filtration tank to Schutt's processing system is to further purifying the recycled spent etchant solution as taught by Allies (column 5, line 64 - column 6, line 5).

Therefore, it would have been obvious to a person of ordinary skill in the art to combine Schutt with Chung et al and Kanda to obtain the invention.

Claims 3-6, 8, 9, 12, 15, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schutt (US 3,532,568 A) in view of Chung et al (U.S.Pat.5,00,795), Kanda (U.S. Pat. No. 4,886,590), and Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Jones et al (U.S. Pat. No. 3,869,313).

Schutt, Chung, Kanda, and Allies are discussed above.

Schutt, Chung, Kanda, and Allies do not disclose expressly a rinse and drying bath for the substrate.

As to claims 3-5, 8, 9, and 12, Jones et al disclose a chemical processing apparatus containing a plurality of treatment chambers having a dip chamber with filling pumps, a spray chamber which serves as a rinse chamber or a drying chamber (col. 2, lines 20-39 and 63-68; col. 3, lines 1-10). The rinse chamber would be filled with deionized water from a deionized reservoir (col. 2, lines 52-55). An essential part of the apparatus is a conveyor means for automatically transferring the workpieces from treatment chamber to treatment chamber. (Fig. 1; Col. 3, lines 50-55). The conveyor allows for a plurality of substrates to be processed substantially at the same time. Using a pump to move fluid from one chamber to another is conventional. Jones further teaches a

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A controlled heater 67" (column 2, lines 28-35) used in the Atreatment chamber that may be used as a drying chamber (column 3, lines 1-3).

As to claim 6, Jones et al disclose a cleaning/etching solution containing hydrofluoric acid (col. 5, lines 49-60; col. 6, lines 33-35 and 51-54). Jones et al disclose cone shaped bottom tanks (Figs. 6A-B).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine the multiple chambers for rinsing and drying of Jones et al with the etching apparatus of Schutt, Chung et al, and Kanda.

The motivation for doing so would have been to provide treating operations such as rinsing and drying of substrates as taught by Jones et al.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schutt (US 3,532,568 A) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Tittle (USPat. 4,886,590). Schutt, Chung, Kanda, and Allies are discussed above. However, Schutt, Chung, Kanda, and Allies do not teach a concentration measuring device of the first etchant.

Tittle teaches a concentration ("characteristic"; column 1, lines 31-36; column 2, lines 17-22) measuring device ("sensors", "chromatograph"; column 1, lines 65-68).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Schutt, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his endpoint detection system.

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Motivation for Schutt, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his process control system is for monitoring when the rinsing solution should be changed or cleaned (column 1, lines 39-41).

(10) Response to Argument

Portions of Applicant's Brief suggest a critical nature of the prosecution history. In response, the Examiner notes that the present case is inherited from a prior Examiner no longer in the patent office. Per MPEP 704.01, the present Examiner gave full faith and credit to the prior Examiner's research.

Applicant states:

"

In rejecting claim 1, the Examiner asserts that Schutt discloses all of the claimed elements except an etch bath including a bubble plate and etching a glass substrate by immersion therein. The Examiner cites Schutt as "chemically etching ("etching zone 1"; Sole figure) material from a substrate (copper, abstract)." So Schutt does not teach a an etch bath that etches a glass substrate to uniformly reduce the thickness of the glass substrate. Rather, Schutt is directed to etching copper from off of a substrate, specifically a printed circuit board. Such a process is typically intended to form conductive patterns on the printed circuit board. Hence, etching a material uniformly to reduce its thickness is completely counter to the goal of Schutt. Accordingly, Schutt and the other cited references fail to teach every feature of the claimed invention.

" (Page 10)

and...

"

Examiner fails to provide any evidence of the desirability of combining Schutt with Chung. Schutt is actually silent as to the specifics of the etching zone, *because Schutt is actually directed to an etching solution having a ferrous ion for etching copper*. Further, *Chung is directed to a*

semiconductor wafer cleaning method and apparatus. The cleaning of Chung is a very different process from the etching of Schutt. Etching is a process of removing a specific material from a surface either in specific areas or in specific amounts. Cleaning is the removal of all undesired impurities, residues, etc. from a surface.

“

and...

“

Kanda and Allies are cited as disclosing control systems for etching apparatuses. They do not disclose or suggest apparatus for etching a glass substrate that includes a first tank, an etch bath and a second tank as claimed.

“

In response, the Examiner emphasizes that the pending apparatus claims should not be limited by specific processes either recited in the pending claims or implied in the prior art. Further, it has been held that claim language that simply specifies an intended use or field of use for the invention generally will not limit the scope of a claim (Walter , 618 F.2d at 769, 205 USPQ at 409; MPEP 2106). Additionally, in apparatus claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim (In re Casey,152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963); MPEP2111.02).

That “Schutt does not teach an etch bath *that etches a glass substrate* to uniformly reduce the thickness of the *glass substrate*” because Schutt’s particular *process* of etching a different

substrate, here copper, as identified by Applicant, does not distinguish Applicant's claimed invention from that of the combined prior art.

In response to applicant's argument that Schutt and Chung are nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Schutt and Chung are each in the field of applicant's endeavor (liquid etching/cleaning of substrates). Further, substrate "cleaning" is commonly a final process that is conducted after an etching step to quench or stop the reaction started during the liquid etching step. Note Chung teaches a "semiconductor wafer cleaning" apparatus (Title) – "cleaning" is done both after and before the liquid etching.

Applicant states:

"

Nowhere in the prior art is there any suggestion of the desirability of replacing the etching zone 1 of Schutt with a bubble plate and tank of Chung. Furthermore, the Examiner asserts that the bubble plate is an alternative and equivalent etching means to the etchant delivery means, however, the Examiner fails to address the fact the bubble plate requires a gas supply which is not disclosed in Schutt. Accordingly, a significant redesign of the system of Schutt would be required in order to accommodate a bubble plate (i.e., the mere replacement of the etching zone with a etch bath is not possible). Further, Schutt is directed to etching copper and more specifically an etching solution to etch copper, and Chung is directed to cleaning semiconductor wafers. These two are directed to completely different problems and fields. Therefore, absent

proper motivation to modify the system of Schutt, the rejection of claims 1,2, 7, 10, 11, 13, 14, 17-22, 25 and 26 is improper

“

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the Examiner stated “the motivation for doing so would be to replace the etchant delivery means (ie, sparger etcher) with an alternate and equivalent etching means (ie a bath etcher).”. The Examiner supports the motivation specifically because such liquid mixing apparatus as described by Chung would promote anisotropic etching resulting from agitating the solution with the sparger disclosed by Chung as would be known artisans of ordinary skill.

Applicant states:

“

In the Examiners Response to Arguments, he states that “etch bath” is not a structural limitation. Applicants disagree. A bath is clearly a structure that holds a liquid. An etch bath happens to be a bath that holds an etching solution.

“(page 11)

In response, the Examiner does not apply any intended use argument on the structure of a “bath”.

The Examiner does believe that any claimed etching solution and/or the identity of the product to be etched is an intended use claim requirement. See above.

Applicant states:

“

Because Schutt, Chung, Kanda and Allies each fail to disclose or suggest an etching apparatus for etching a glass substrate that includes a first tank, an etch bath and a second tank as claimed, the combination of these four references cannot possibly disclose or suggest said features. Therefore, even if one skilled in the art were motivated to combine Schutt, Chung, Kanda and Allies, the combination would still fail to render claim 1 unpatentable for at least the reason that the combination fails to disclose each and every claimed element.

“

In response to applicant's argument that the examiner has combined an excessive number of references, reliance on a large number of references in a rejection does not, without more, weigh against the obviousness of the claimed invention. See *In re Gorman*, 933 F.2d 982, 18 USPQ2d 1885 (Fed. Cir. 1991).

Applicant states:

“

First, as discussed above with respect to claim 1, the Examiner fails to provide proper motivation of modify the system of Schutt to include an etch bath. Furthermore, nowhere in Schutt is there any suggestion of the desirability of controlling the etching process based on the temperature of

the etchant, because Schutt is directed to an etching solution. Accordingly, absent proper motivation to modify the system of the Schutt, the rejection of claim 10 is improper.

"

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The Examiner has demonstrated that Kanda's teaching of process monitoring and control of a liquid etching process is a desirable feature for artisans of ordinary skill in the art. In response to the Examiner's demonstrated desirability for Schutt to use Kanda's process monitoring and control, Applicant states:

"

Kanda discloses controlling the etching process based on the thickness of the substrate, which is calculated based on the speed of the etching process, which in turn is based on the temperature of the etchant. The mere fact that Kanda discloses measuring the temperature of the etchant solution is not equivalent to terminating the etching process when the temperature reaches a termination temperature. Nowhere in Kanda is there any disclosure or suggestion of determining a termination temperature, much less terminating the etching process once the termination temperature has been reached

"

In response, the Examiner disagrees. Specifically, Kanda's performance metric "P" is shown to be a function of temperature "T" and time "M" (column 10; line 35). It is noted that Kanda's thermocouple 52; Figure 10 is constantly measuring temperature and delivering the measurement

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to Kanda's controller 47, Figure 10. Among the many temperatures recorded in Kanda's etching bath 8, Figure 10 is Applicant's claimed "termination temperature" when Kanda's P metric "is close to 0, etching is terminated" (column 10, lines 38-40). Further, the Examiner emphasizes that an artisan of ordinary skill would also know how to rearrange Kanda's P equation to read temperature T as the dependent variable.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Rudy Zervigon, Primary Examiner, Art Unit 1792



Conferees:

Parviz Hassanzadeh (SPE, Art Unit 1792) 

Romulo Delmendo (QAS, TC 1700) 